

REMARKS

I. Status of the Application

Claims 19-35 are presently pending in the application. Claims 36-53 are newly added. Claims 20-35 stand rejected as depending on a withdrawn claim. Claim 19 stands rejected under 35 USC § 102(b) as being anticipated by Rhodes et al. WO 84/01740. Attached hereto is a marked up version of the changes made to the claims entitled "Version of Amendments with Markings to Show Changes Made."

Applicant has amended claims 20-35 to provide proper dependency. Accordingly, applicant requests that the rejection under 35 USC § 112 be withdrawn.

Applicant has amended claim 19 to recite an upper arm that is rotatable at least 360° about a shoulder axis. Support for the amendment is found at page 8, lines 1-5. Accordingly, no new matter has been added. Newly added claims 36-53 describe alternate embodiments of the present invention, support for which can be found throughout the specification. The foregoing amendments in view of the following remarks are believed to place all pending claims of this application in condition for allowance. Accordingly, reconsideration of the application and allowance of claims 19-53 as now submitted is respectfully requested.

II. Claims 19-53 Are Novel Over Rhodes et al. WO 84/01740

Claim 19 has been rejected under 35 U.S.C. § 102(b) as being anticipated by Rhodes et al. WO 84/01740 ("Rhodes"). This rejection is respectfully traversed as to the amended and newly added claims now presented.

Rhodes discloses a robotic arm having an upper arm 28 rotatably secured to a body 16 by a shoulder joint 30. A forearm 32 is rotatably secured to upper arm 28 by elbow joint 34. A hand 36 is coupled to forearm 32 by a wrist joint 38.

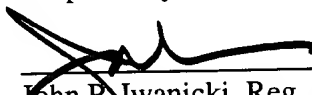
Rhodes does not disclose or make obvious a manipulator having an upper arm that is rotatable at least 360° about a shoulder axis relative to a foot part, as required by independent claim 19, nor a lower arm that is rotatable at least 360° about an elbow axis relative to the upper arm, as required by new dependent claim 36. Upper arm 28 of Rhodes is rotatable only approximately 180° about body 16 (see page 8, lines 7-9). Forearm 32 is rotatable only approximately 180° about elbow joint 34 (see page 8, lines 4-6). Thus, the robotic arm of Rhodes does not realize the freedom of movement and resultant increased area that can be reached by the manipulator of the present invention. Claims 20-35, which depend from claim 19, are believed to be allowable as well. Newly added claims 37-53, which also recite the 360° subject matter, are believed to be novel and non-obvious, and, therefore, are believed to be allowable as well.

In view of the foregoing amendments and remarks, pending claims 19-53 are believed to be allowable, and an indication to that effect from the Examiner is respectfully requested at this time. If a telephone conversation with applicant's attorney would expedite prosecution of the above-referenced application, the Examiner is urged to call the undersigned at the number below.

Please apply any required charges or credits to our Deposit Account No. 19-0733.

Date: May 29, 2002

Respectfully submitted,



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Version of Amendments With Markings to Show Changes Made

In the Claims:

Claims 19-35 have been amended as follows:

19. (Amended) A manipulator comprising a foot part and a number of members connected to the foot part and to each other respectively, and at least a gripper part, such that the members and the gripper constitute, with the foot part, an arm, wherein drive means, in particular motors for moving at least a number of the members and the gripper are provided in the foot part wherein a first member, in particular [the] an upper arm, is rotatable at least 360° about a shoulder axis relative to the foot part and a second member, in particular [the] a lower arm, is rotatable about an elbow axis relative to the first member, [characterized in that] wherein compensating means being provided in the footpart for the first and second member which, upon movement of the members, at least partially compensate for the moment exerted by the first member relative to the foot part and by the second member relative to the elbow axis, the arrangement being such that thus, during use, couples acting on a number of drive means are limited.

20. (Amended) A manipulator according to claim 19, wherein the shoulder axis and the elbow axis, during use, extend substantially parallel to each other and preferably horizontally, and are located adjacent opposite ends of the first member, the gripper being rotatable about at least a first gripper axis relative to the second member, said first gripper axis preferably enclosing an angle of about 90° with the elbow axis.

21. (Amended) A manipulator according to claim 19, wherein the shoulder axis comprises at least a first rotary shaft and a second rotary shaft, the first rotary shaft being coupled to the first

member and the second rotary shaft being coupled to the second member, the compensating means comprising a first eccentric coupled to the first rotary shaft and a second eccentric coupled to the second rotary shaft, first and second spring means being coupled to the first and the second eccentric respectively, the eccentrics being directed such that at the maximally reachable horizontal position of the relevant arm part, the force exerted on the relevant rotary shaft by the spring means is maximal and at the maximally reachable vertical position of the relevant arm part, said force is minimal.

22. (Amended) A manipulator according to claim [3] 21, wherein the spring means comprise a first and a second compression or tension spring which are at least substantially accommodated in the foot part, with a first and a second band-shaped element respectively extending from the springs over the first and second eccentric respectively, the end distal from the relevant spring being fixed in position, the arrangement being such that upon rotation of an eccentric by means of the relevant rotary shaft, the relevant spring changes in length.

23. (Amended) A manipulator according to claim 19, comprising [at least a first member to be referred to as upper arm, movably connected to the foot part, a second member to be referred to as lower arm, movably connected to the upper arm, and] a gripper connected to the upper arm, wherein the drive means, in particular motors for moving the upper arm, lower arm and gripper are provided in the foot part.

24. (Amended) A manipulator according to claim [5] 23, wherein a third member is provided, to be referred to as a wrist, included between the second member and the gripper, drive means

for the wrist being included in the foot part.

25. (Amended) A manipulator according to claim 19, wherein the drive means comprise a series of motors, each motor being coupled to a reduction casing aligned therewith, the reduction casing being connected to a drive wheel connected, via transmission means, to one of a number of drive shafts, included in or adjacent a shoulder, of parts to be driven, in particular the members such as upper arm, lower arm, wrist or gripper.

26. (Amended) A manipulator according to claim [7] 25, wherein a number of reduction cases are mutually identical, each connected to a drive shaft mounting the relevant drive wheel, the assemblies of reduction casing and drive wheel differing from each other only by the position of the drive wheel relative to the relevant motor.

27. (Amended) A manipulator according to claim 19, wherein at least the first member is at least partially hollow, a series of first drive shafts extending from the foot part into the first member, a series of second drive shafts being provided in the second member, said drive shafts being fitted coaxially one within the other, while between the shafts, a number of bearing means are included or formed, a number of the first shafts at the end remote from the foot part being provided with a first drive wheel, while a number of the second shafts are provided with a second drive wheel, a first drive wheel in each case being drivingly connected, via a coupling element, to a second drive wheel, the drive means in the foot part being arranged for driving the respective first drive shafts, the arrangement being such that both the first member and the second member [is] are movable via the first drive shafts.

28. (Amended) A manipulator according to claim [9] 27, wherein the second member comprises a series of third shafts, whose longitudinal direction extends approximately at right angles to the longitudinal direction of the second shafts, a number of the second and third shafts being provided with mating, preferably frustoconical gears for transmitting rotational movements of the relevant second shafts to the relevant third shafts, at least a number of the third shafts being connected to a third member to be referred to as a wrist, movably connected to the end of the second member remote from the first member.

29. (Amended) A manipulator according to claim [10] 28, wherein the gripper is provided on the side of the wrist remote from the first member and is biased in an open position, while a spring element extends through the wrist, on one side connected to a block slidable in longitudinal direction of the first member through rotation of one of the third shafts, and on the other side connected to the gripper, such that upon rotation of the relevant third shaft, the block is displaced in longitudinal direction while displacing the spring element and/or changing the length thereof, enabling the gripper to be pulled from the open position into a closed position and vice versa.

30. (Amended) A manipulator according to claim 19, wherein the foot part comprises a foot plate which, by means of a bearing, is rotatably connected thereto adjacent the lower end of the foot part, a number of sliding contacts being provided for transmitting an electric tension between the drive means and a power supply located outside the foot part, and[, possibly,] a control unit.

31. (Amended) A manipulator according to claim [12] 30, wherein the bearing for the foot plate comprises an annular groove in the outer circumference of the foot plate and a corresponding annular groove on an inner surface of a tube of the foot part, the relevant outer circumference of the foot plate being substantially identical to the relevant inner circumference of the tube and both grooves having a substantially V-shaped section, such that the two grooves together define a ball track of a substantially rectangular, in particular square or diamond-shaped section which includes a series of balls whose describing line corresponds to said section of the ball track.

32. (Amended) A manipulator according to claim [13] 31, wherein an opening is provided in the tube, said opening ending in the ball track and having a passage which is approximately equal to the cross section of the balls, closing means being provided for closing said opening after insertion of the balls.

33. (Amended) A manipulator according to claim 19, wherein the foot part is substantially formed from a substantially tubular extrusion section, recesses being provided for the drive means.

34. (Amended) A manipulator according to claim 19, wherein spaces are provided in the foot part for accommodating spring means for compensating means, electronic components and the like.

35. (Amended) Use of a manipulator according to claim 19 in a space unsuitable for human entry, such as a radiation space or a toxic space.